

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions, and listings, of claims in the application.

1. (Currently Amended) An external fixation apparatus comprising:
a first member attachable to a first bone segment through a pin;
a lockable ball joint connected to the first member;
a pivot arm ~~second member~~ attachable to the first member through a the
lockable ball joint, the pivot arm ~~second member~~ comprising a first end portion and a second
end portion ~~stem directly adjacent and coupled to a pin clamp~~, wherein the first end portion
and the second end portion ~~ends of the stem~~ may be translated transversely relative to one
another and to a longitudinal axis of the pivot arm ~~stem~~; and
a pin clamp coupled to and rotatable about the second end portion of the pivot
arm ~~stem~~ through a lockable joint, the pin clamp being attachable to a second bone segment.

2. (Original) The external fixation apparatus of claim 1, wherein the first bone segment is a tibia and the second bone segment is a talus or a calcaneus.

3. (Currently Amended) The external fixation apparatus of claim 1, wherein translation of the first and second end portions ~~ends of the stem~~ relative to the longitudinal axis of the pivot arm ~~stem~~ is possible in at least two dimensions.

4. (Currently Amended) The external fixation apparatus of claim 1, 2, wherein the pivot arm stem includes:

an upper recess and a lower recess;

a carriage that fits within ~~an~~ the upper recess and a the lower recess ~~of the stem~~, the carriage including two threaded holes each receiving a worm gear; and

keybolts that operate each worm gear such that the carriage may be moved transversely to the longitudinal axis in one dimension within the upper recess and transversely to the longitudinal axis in another dimension within the lower recess.

5. (Currently Amended) The external fixation apparatus of claim 1, wherein the pivot arm stem has a single prong at the its second end portion.

6. (Withdrawn) The external fixation apparatus of claim 1, wherein the lockable joint coupling the second member and the pin clamp comprises:

an axle extending through a hole in a first jaw of the pin clamp and a hole in the second end of the second member;

an anti-rotation pin inserted through a portion of the second member and into the axle; and

a first bolt that passes through openings in first and second jaws of the pin clamp such that tightening of the first bolt interferes with the axle and locks rotation of the pin clamp and the second member.

7. (Withdrawn) The external fixation apparatus of claim 1, wherein the lockable joint coupling the second member and the pin clamp comprises:

a threaded sleeve fixed to the second member; and

a core with internal hex driving sockets that is threaded onto the sleeve so that as the core is moved along the sleeve, balls are forced up ramps and into the pin clamp or allowed to move down ramps and away from the pin clamp.

8. (Withdrawn) The external fixation apparatus of claim 1, wherein the lockable joint coupling the second member and the pin clamp comprises:

a biasing element; and

a pushbutton core contacting the biasing element such that when the pushbutton core is depressed the pin clamp may rotate freely.

9. (Withdrawn) The external fixation apparatus of claim 1, wherein the lockable joint coupling the second member and the pin clamp provides for multi-axis rotation between the second member and the pin clamp.

10. (Withdrawn) The external fixation apparatus of claim 9, wherein the lockable joint coupling the second member and the pin clamp comprises:

a sphere suspended from the second end of the second member that is received within interior surfaces of first and second jaws of the pin clamp; and

at least one bolt that passes through openings in at least one of the first and second jaws of the pin clamp such that tightening of the at least one bolt interferes with the sphere and locks rotation of the pin clamp and the second member.

11. (Withdrawn) The external fixation apparatus of claim 9, wherein the lockable joint coupling the second member and the pin clamp comprises:

a sphere attached to the pin clamp; and

a compression bolt that extends through holes in the sphere of the pin clamp and the second member so that when the bolt is tightened with a lock nut, the second member is compressed against the sphere thereby locking rotation of the second member and the pin clamp.

12. (Withdrawn) The external fixation apparatus of claim 9, wherein the lockable joint coupling the second member and the pin clamp comprises:

a connector that is held within a sphere-shaped tip of the second member by a retaining cap and a biasing element, the connector having a ball end and a threaded end; and

a cooperating surface of the pin clamp that receives the sphere-shaped tip of the second member and the threaded end of the connector; and

a nut that is threaded onto the threaded end of the connector to retain the connector within the pin clamp and such that when the nut is tightened the sphere-shaped tip of the second member and the cooperating surface of the pin clamp are locked against one another.

13. (Withdrawn) The external fixation apparatus of claim 9, wherein the lockable joint coupling the second member and the pin clamp comprises:

a connector held within a sphere-shaped tip of the pin clamp;

a cooperating surface of the second member that receives the sphere-shaped tip of the pin clamp and a shaft end of the connector; and

a wedge bolt extending through the second member that is tightened by a wedge nut causing a ramp to force a ball end of the connector to be pulled up forcing the sphere-shaped tip of the pin clamp and the cooperating surface of the second member to lock against one another.

14. (Withdrawn) The external fixation apparatus of claim 9, wherein the lockable joint coupling the second member and the pin clamp comprises:

two stacked washers attached to a spherical portion of the second member;

two stacked washers attached to the pin clamp, wherein the two stacked washers of the pin clamp are alternately nested with the two stacked washers of the second member; and

a bolt extending from the pin clamp and into the spherical portion of the second member such that all of the washers and the spherical portion are pressed together upon tightening of the bolt, thereby locking rotation of the pin clamp and the second member.

15. (Withdrawn) The external fixation apparatus of claim 1, wherein the second member is biased at the second end from the longitudinal axis of the second member up to approximately sixty degrees.

16. (Currently Amended) The external fixation apparatus of claim 1, wherein the lockable joint coupling the pivot arm stem and the pin clamp comprises:

a shaft extending transversely from the second end portion of the stem, the shaft including at least one groove extending around at least a portion of a circumference of the shaft;

a hole within a first jaw of the pin clamp that receives the shaft;

a locator pin of the pin clamp that is received within the at least one groove to releasably couple the pivot arm stem and the pin clamp; and

a first bolt that passes through openings in the first jaw and a second jaw of the pin clamp such that tightening of the first bolt interferes with the shaft and locks rotation of the pin clamp about the pivot arm stem.

17. (Original) The external fixation apparatus of claim 1, wherein the pin clamp is symmetrical or asymmetrical.

18. (Currently Amended) An external fixation apparatus comprising:

a first member attachable to a first bone segment through a pin;

a lockable ball joint connected to the first member;

a second member attachable to the first member through a the lockable ball joint, the second member comprising a first end portion and a second end portion, the second end portion comprising ~~including~~ a shaft extending transversely ~~therefrom a distal end of the second member~~ with at least one groove extending around at least a portion of a circumference of the shaft; and

a pin clamp attachable to a second bone segment and releasably coupled to and rotatable about the second member, the pin clamp comprising:

a first jaw and a second jaw, the first jaw including a hole that receives the shaft;

a locator pin that is received within the at least one groove of the shaft to releasably couple the second member and the pin clamp; and

a first bolt that passes through openings in the first and second jaws such that tightening of the first bolt interferes with the shaft and locks rotation of the pin clamp about the second member.

19. (Currently Amended) The external fixation apparatus of claim 18, wherein the first and second end portions ~~a proximal end and the distal end of the second member~~ may be translated transversely relative to a longitudinal axis of the second member.

20. (Currently Amended) The external fixation apparatus of claim 19, wherein translation of the first and second end portions ~~proximal and distal ends of the~~

~~second member~~ is possible in at least two dimensions and the second member further comprises ~~includes~~:

an upper recess and a lower recess;

a carriage that fits within the ~~an~~ upper recess and the ~~a~~ lower recess of the second member, the carriage including two threaded holes each receiving a worm gear; and

keybolts that operate each worm gear such that the carriage may be moved transversely relative to the longitudinal axis in one dimension within the upper recess and transversely relative to the longitudinal axis in another dimension within the lower recess.

21. (Original) The external fixation apparatus of claim 18, wherein the locator pin is pulled to allow for release of the second member from the pin clamp.

22. (Withdrawn) The external fixation apparatus of claim 18, wherein the locator pin is pushed to allow for release of the second member from the pin clamp.

23. (Original) The external fixation apparatus of claim 18, wherein the pin clamp further comprises second and third bolts that hold the first and second jaws together and attach and clamp pins or wires to the second bone segment.

24. (Original) The external fixation apparatus of claim 23, wherein the pin clamp further comprises openings in the first and second jaws that receive biasing elements and threaded ends of the second and third bolts.

25. (Currently Amended) An external fixation system for attaching pins or wires to at least one bone segment, the system comprising:

~~an external fixation device; and~~

a first member;

a second member coupled to the first member, the second member comprising a shaft that extends transversely from an end portion of the second member and has at least one groove extending around at least a portion of a circumference of the shaft; and

a pin clamp comprising:

a first jaw and a second jaw, each of the first and second jaws having openings;

biasing elements received within the openings, the biasing elements adapted to bias the first and second jaws toward each other ~~in the first and second jaws;~~

first and second bolts that extend into ~~through~~ the openings in the first and second jaws, the first and second bolts adapted to compress ~~compressing~~ the biasing elements and hold ~~holding~~ the first and second jaws together;

a hole in the first jaw configured to receive a the ~~shaft that extends transversely from an end of an external fixation device, the shaft having at least one groove extending around at least a portion of a circumference of the external fixation device; and~~

a locator pin that is received within the at least one groove of the shaft to releasably couple the second member ~~external fixation device~~ and the pin clamp; ~~and~~

~~a third bolt that passes through the openings in the first and second jaws such that sufficient tightening of the third bolt interferes with the shaft and locks rotation of the pin clamp about the external fixation device.~~

26. (Withdrawn) The pin clamp of claim 25, wherein the external fixation device is a handle such that the pin clamp and handle coupled thereto may be used as a drill guide.

27. (Withdrawn) The pin clamp of claim 25, wherein the external fixation device is a fixation component that includes a capture member that receives a pin, bar, or wire.

28. (Currently Amended) The system ~~pin clamp~~ of claim 25, wherein the ~~external fixation device is a second member~~ has at least one other end portion and the end portions with first and second ends that may be translated transversely relative to a longitudinal axis of the second member in at least two dimensions.

29. (Currently Amended) The system ~~pin clamp~~ of claim 25, wherein the locator pin is pushed or pulled to allow for release of the shaft ~~external fixation device~~ from the pin clamp.

30. (Currently Amended) A method of treating a skeletal condition or injury using an external fixation apparatus, the method comprising:

(a) fixing a first member to a first side of a fracture with upper bone pins;
~~the first member being coupled to a second member through a lockable ball joint;~~

(b) fixing a pin clamp to a second side of the fracture with lower bone pins;
~~the pin clamp being coupled to and rotatable about a stem of the second member through a second lockable joint, the stem being directly adjacent to the pin clamp and comprising first and second ends; and~~

(c) coupling the pin clamp to the first member through the use of a pivot arm having first and second end portions, the first member being coupled to the first end portion through a lockable ball joint and the pin clamp being coupled to the second end portion through a second lockable joint;

(d) (e) adjusting the first and second end portions ~~a first end and a second end of the stem~~ relative to each other and transversely relative to a longitudinal axis of the pivot arm ~~stem~~ to precisely reduce the fracture.

31. (Currently Amended) The method of claim 30, further comprising rotating the pin clamp ~~about the stem to~~ as desired for placement of the lower bone pins.

32. (Original) The method of claim 30, wherein the pin clamp is fixed prior to the fixing of the first member.

33. (Currently Amended) The method of claim 30, wherein the first and second end portions ~~ends of the stem~~ may be adjusted transversely relative to the longitudinal axis of the pivot arm stem in at least two degrees of freedom.

34. (Currently Amended) The apparatus of claim 1, wherein the pin clamp is releasably coupled to the pivot arm stem.

Claim 35 (canceled)

36. (Currently Amended) The apparatus of claim 1 ~~35~~, wherein movement of the first end of the pivot arm stem and movement of the second end of the pivot arm stem are in separate axes isolated from one another.

Claims 37-40 (cancelled)

41. (New) The external fixation apparatus of claim 1, further comprising a carriage operatively connected to the first and second end portions.